# Land Cover – Basic & Advanced

GLOBE Inquiry Model: DRAFT OUTLINE SHOWING TIME AND SEQUENCE
Total Time 15.25 hours (2 days, including max. travel time)
        Day 1: Content 7.00 hours, Total time: 8.25 hours
        Day 2: Content 5.75 hours, Total time: 7.00 hours
        Prep time:  2 days

**Note:** *This outline provides you with a framework for agenda planning for implementation of the GLOBE inquiry-based training model. We have provided a basic content outline as well as a timeframe for completion of all activities.  Currently, we have plans to develop and distribute <u>complete lesson plan packages</u> for each protocol area by the end of the current calendar year.*

## Pre-prep:
### Trainer:
Check for GLOBE data in the area
Have photos from the sites the trainer gathers
Land Cover issues from the site coordinator, local trainees
Gather LC sites for assessment (MUC, photos, GPS)
Rental car/transportation to gather sites
Make manual LC map from image.

### From the Partnership:
Does partnership want a hi or lo tech approach?
Topo maps
Road Maps
Aerial photos
Clinometers and densiometers provided by others (at site?  GLOBE?)
Instructions to observe land covers along the way
Is there a capable systems person on site?  Can we have that person at all times?

## Equipment Requirements:  (Should be tailored to the site; i.e.  no grasslands, don't send shears.)
Camera and development (digital?  Polaroid)
MUC Field guides
Densiometers and clinometers
GPS    Data sheet/field guides
Landsat image
        True color and IR prints  (1 copy each per participant)
        Disk based
Video: TV/VCR or Computer projector
Blank transparencies, marking pens, very fine points, scotch tape
Power Points
Tape measures, flags, compasses
Carry bags

Calculators
Grass shears, brown bags, meter sticks
Maps, aerial photos
Overhead projector
Computer projector, if available
Chart paper/white board and markers

## Pre-training:
### Participants:
Review Basic land cover protocols and especially MUC.

### Trainer:
Do the composite change image to be aware of changes.
Be certain that you have both old and new images for change detection.
Review the "Participant – Host Needs" document.

## Outcomes:
### Basic Training:
1. Become familiar with major land cover types and locate them on the landsat image.
2. What is the purpose of the map? Generate research questions. Understand why we need a base map.
3. Basic understanding of what a remote sensing image is, particularly with respect to true and false color
4. Understand the need for classification and ground validation of remotely sensed data.
5. Be able to crease a meaningful manual land cover map.
6. Be able to use the MUC guide to distinguish different classes.
7. Be able to take, record, and report data.
8. Be familiar with using the GLOBE website, especially data entry and retrieval.
9. Understanding of the mechanics of Accuracy Assessment, and be able to perform.

### Advanced Training:
1. Be able to use MultiSpec to:
   a. open an image.
   b. change band combinations.
   c. zoom in and out.
   d. view Spectral graphs and compare them.
   e. identify different land cover types.
   f. cluster an image.
   g. change the color and label of a cluster.
   h. save the clustered image as a TIFF file and send to GLOBE.
   i. composite two registered images.

j.  view different band combinations in the composite image and detect changes in different land cover types.

## Training Schedule:

## <u>DAY 1:</u>

I.  **What types of land cover did you see on your way to the workshop?** (20 min.) (indoors)
   a.  Do a rough map of the LC's observed on blank chart paper, vue graph, etc.

II. **Locate the sites on existing maps.** (45 min.)
   a.  Locate same sites on campus maps, road maps, topos, aerial photos, as available.
        i.  Emphasize that maps are inherently inaccurate because of date, distortion of projection, the maker, scales, etc.
   b.  Locate the same sites on the True Color image only.
        i.  This is not a map, but another view of the area acquired by the Landsat system of satellites at heights of 705 km.

III. **Develop research/inquiry questions.** (30 min.)
   **Note:** Questions should be tailored to the local needs, and this must be flexible.
   a.  Discussion of local issues.
        i.  Can they locate sites that are in local news?
   b.  Why look at land cover?
   c.  Why do we need these maps?
   **d.**  What can we use these maps for?
   **e.**  What kinds of decisions are made using maps?
   **f.**  What kinds of land cover are important in this area?
   **g.**  Does everyone need to make maps on the same theme?
   **h.**  How is mapping related to land use decision.

IV. **Break.** (15 min.)

V.  **Introduction to Remote Sensing.** (40 min.)
   a.  Use video, PowerPoints, and/or transparencies.
   b.  Focus on:
        i.  true and false color imaging.
        ii. pixels, images vs. pictures.
        iii. digital data from the satellite.
        iv. the landsat channels and the parts of the spectrum that they represent.
        v.  stress the use of channel four in vegetative identification.
   c.  We must look at sites that are 90 m x 90 m, and are homogeneous in composition.

        i.  Define homogeneous as having the same MUC value for all pixels in the area.

VI.  **Manual mapping.** (40 min.)
- a.  Have groups compare individual maps.
  - i.  What differences are there?
  - ii.  How can we reconcile these differences?

VII.  **Lunch** (60 min.)

**Note:** By this point, people may have used different terms to describe the same land cover type.  Bring out, if the participants do not get to it themselves, that we need a set of universal terms to describe land cover types.  We will use a system called "MUC", more on which will come later.

VIII.  **Show a land cover classification map.** (20 min.)
- a.  Use one that the trainer has done from the image.
- b.  How good is it?
  - i.  We need to do ground validation as a source of data for Accuracy Assessment.  (<u>Note:</u>  This topic may come up in discussion earlier, and it is fine to cover it then)

IX.  **Land Cover Sample Site – introduction.** (15 min.)
- a.  Give a quick introduction to the MUC system, and the MUC field guide.
  - i.  Discuss necessary properties for a classification system (ie. exhaustive, mutually exclusive, etc.).
- b.  Introduce GPS, Biometry measurements, and metadata.

X.  **Land Cover Sample Site – field work: capturing the data.** (210 min. = 3.5 hrs.)

**Note:** Trainer should investigate the area and pre-select sample sites.  Ideally, there should be a couple different sites.  One should be a natural site, where biometrics are to be taken, and may be a distance away.   The other site should be developed, local, and on the way to the natural site.
- a.  Travel to sites.
- b.  Reinforce that these sites must be 90 m x 90 m.
- c.  All Land Cover Sample Sites include:
  - i.  MUC
  - ii.  GPS (5 min data must be taken at each site)
  - iii.  Photographs (one in each cardinal direction).
- d.  Biometry data are taken at natural site.
  - i.  Participants should take any biometry data that are needed to accurately determine the MUC value of the site.
  - ii.  Participants should be able to carry out all the biometry measurements as outlined in the protocol.
- e.  Take Metadata when applicable.

      **i.** Participants should gather any and all data that might be of importance in understanding the site, its history, etc.

# DAY 2:

**XI.** **Add data from sample sites to the map.** (20 min)
    a. These site data are now used to make the land cover map more accurate.

**XII.** **Data entry and related computer work.** (60 min.)
**Note:** If this is a stand-alone module, participants need ID's.
    a. Enter data that has been collected.
    b. Explore GLOBE space.
    c. Retrieve data.

**XIII.** **Break.** (15 min)

**XIV.** **MultiSpec tutorial and clustering.** (120 min.)

**XV.** **Lunch.** (60 min.)

XVI. **Accuracy Assessment.** (40 min.)
    a. Use the data gathered by the trainer.
    b. Construct the Accuracy Assessment matrix.
    c. Calculate overall accuracy.
    d. If there are sufficient data, point out how the matrix shows trends in errors or biases in estimating land cover types. If not, use a prepared matrix to show error patterns.
    e. It is important to note that visited sites used in the construction of the map may not be used in constructing the error matrix.
    f. Divide the group into teams to assess both the manual and electronic maps.
    g. Have a discussion about the differences between the results.
        i. Are there land cover types that the system does not separate in the clustering?
        ii. Are there land cover areas that are artificially split by the computer process?
        iii. Are there land cover types that the manual mapping distinguished that were not found in the computer assisted mapping?

**XVII.** **Change Detection.** (60 min.)
    a. Composite two images.
    b. Demonstrate change and how to view.
    c. What questions can we answer at this stage?

**XVIII. Follow up and discussion.** (25 min)
    a. Where would you go from here in using land cover maps to answer the questions you posed at the beginning?
    b. Can you reach any conclusions yet?
    c. What other types of data would you need to help you answer your questions?
    d. As trainers, how are you going to translate this to your own area?
    e. A methods discussion: What questions/comments do you have on how the training was carried out?
    f. Point out:
        i. Research of the PI
        ii. Student research
        iii. MUC-A-Thons
        iv. Training resources (learning activities, etc.)

## FYI:

  I. The training schedule for a basic training would consist of the above, except for sections XIV (MultiSpec tutorial and clustering) and XVII (Change Detection). Also, section XVI (Accuracy Assessment) would not include electronic maps.
  II. Use **Sidebars** ("When you train this, you will have to……..") sprinkled throughout the day. These sidebars to your audience will help them.